26. $\lim_{n\to\infty} \frac{5n}{2n-1} = \lim_{n\to\infty} \frac{5}{2} = \frac{5}{2}$ converges

$5, \frac{10}{3}, \frac{15}{5} \to \frac{5}{2}$

I

$\sum_{n=1}^{\infty} \frac{5n}{2n-1} = 5 + \frac{10}{3} + \frac{15}{5} \ldots = \infty$

terms approach $\frac{5}{2}$

series diverges by n^{th} term test n^{th} term $\to 0$

XII $\lim_{n\to\infty} \frac{e^n}{n} = \lim_{n\to\infty} \frac{e^n}{1} = \infty$ diverges

III $\lim_{n\to\infty} \frac{e^n}{1+e^n} = 1$ converges

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28. $\lim_{h\to 0} \frac{\ln(e+h)-1}{h} = f'(e)$ $\lim_{h\to 0} \frac{f(a+h)-f(a)}{h} = f'(a)$

A $f(x) = \ln x$

$a = e$

$f'(x) = \frac{1}{x}$

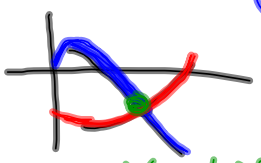
$f'(e) = \frac{1}{e}$

32. $0 \le x \le 4$

$\int_0^x t^2 - 2t\,dt \ge \int_2^x t\,dt$

$\frac{t^3}{3} - t^2 \Big|_0^x$ $\frac{t^2}{2} \Big|_2^x$

$\frac{x^3}{3} - x^2 \ge \frac{x^2}{2} - \frac{2^2}{2}$



$x \approx 1.388$

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33. $\frac{dy}{dx} = (1+\ln x)\,y \qquad y=1,\ x=1$

$$\int \frac{dy}{y} = \int (1+\ln x)\,dx$$

$$\ln|y| = x + x\ln x - x + C$$

$$\ln 1 = 1\ln 1 + C$$

$$0 = C$$

$$y = e^{x\ln x}$$

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38. $f(x) = \int_0^{x^2} \sin t\,dt$ (chain rule)

$$f'(x) = \sin x^2 \cdot 2x$$

inst rate = ave rate

$$f'(x) = \frac{f(b)-f(a)}{b-a}$$

$$2x\sin x^2 = \frac{f(\sqrt{\pi})-f(0)}{\sqrt{\pi}-0}$$

$$2x\sin x^2 = \frac{\int_0^{\pi}\sin t\,dt - \int_0^{0}}{\sqrt{\pi}}$$

$$2x\sin x^2 = \frac{1}{\sqrt{\pi}}\int_0^{\pi}\sin t\,dt$$

f_1 f_2

$$2x\sin x^2 = \frac{2}{\sqrt{\pi}} \quad \text{on } [0,\sqrt{\pi}]$$

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39. Initial value problem?

$$f(x) = \int \frac{x^2}{1+x^5}\,dx \qquad f(1) = 0$$

$$f(4) = ?$$

$$f(x) = \int_1^x \frac{t^2}{1+t^5}\,dt + C$$

$$f(4) = \int_1^4 \frac{t^2}{1+t^5}\,dt = .3756$$

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Review 19 FTC

Version I $\frac{d}{dx}\int_a^x f(t)\,dt = f(x)$

$$\frac{d}{dx}\int_1^x \frac{\sin t}{t}\,dt = \frac{\sin x}{x}$$

$$\frac{d}{dx}\int_1^{x^2} \frac{\sin t}{t}\,dt = 2x\,\frac{\sin x^2}{x^2}$$ - chain rule

$$\frac{d}{dx}\int_{x^2}^{x^3} \frac{\sin t}{t}\,dt = \frac{3x^2 \cdot \sin x^3}{x^3} - 2x\,\frac{\sin x^2}{x^2}$$

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Version II $\int_a^b f(x)\,dx = F(b) - F(a)$

$F(x)$ is an antiderivative of $f(x)$

ex. $F(x) = \int_0^x f(t)\,dt$

a) when does $F(x)$ have a max? a min?

b) graph $F(x)$

(Sketch a possible graph)

$F'(x) = f(x)$

max at $x = 1$
b/c F' changes from + to −

min at $x = 0, 3$
b/c F' pos at left endpt
F' neg at right endpt

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